Introduction

The potential for oil exploration on the Yukon Flats National Wildlife Refuge (refuge) is high. An exploratory well was planned on private lands south of Fort Yukon in 1991. The drilling was delayed, however interest in oil development remains high. Should economically viable amounts of oil or gas be found, there is the potential for extensive oil and gas development (U.S. Fish and Wildlife Service 1987). The Fish and Wildlife Service (FWS) must provide access to inholdings and right of way for oil pipelines across refuge lands should exploration begin and development occur (Alaska National Interest Lands Conservation Act Title XI, Sec. 1110(b) Public Law 96-487, 1980). Detailed information on the relative distribution and abundance of waterfowl on the refuge is needed to assess the impacts of potential development and to identify proposed pipeline routes with the least impact.

A variety of waterfowl work has been done on the refuge. Lensink (1962, 1965) conducted aerial breeding pair surveys and duck production surveys in the early 1950's and 1960's as part of the impact studies for the proposed Rampart dam project. North American Breeding Pair Surveys have been flown on the Yukon Flats for over 30 years (Conant and Dau 1991). Aerial survey transects were added by the refuge to the breeding pair survey from 1984-86 to improve distribution and population information and brood surveys have been conducted since the early 1960's (U.S. Fish and Wildlife Service, 1983-86). Site specific research projects have examined basic biology and habitat affinities of waterfowl (Heglund 1988; Grand and Esler 1990). These studies provide a general knowledge and historic perspective of waterfowl distribution and abundance on the refuge.

The Division of Migratory Bird Management (MBM) expanded the number of breeding pair transects flown on the area in 1989 and 1990 (Hodges 1990). Although the objective of this work was to develop better statewide population estimates for waterfowl, the techniques and results provide excellent data for refuge management. Also, in 1990, MBM began a statewide standardized duck production survey (U.S. Fish and Wildlife Service 1990; Hodges and Conant 1990; Hodges 1991). This resulted in the delineation of a Yukon Flats Duck Production stratum (DPS) which encompassed the primary waterfowl habitat on the refuge. We analyzed 1989-90 expanded breeding pair survey data to evaluate the relative importance of the DPS, and increased both transects and duck production plots within the DPS in 1991 to provide improved baseline waterfowl information for impact assessment.

The Division of Migratory Bird Management has developed aerial survey techniques that provide for the production of very accurate waterfowl density distribution maps. These maps can be

used for impact assessment and other management purposes. For example, the Division of Realty has developed an Alaska Priority System (APS) model for evaluating private lands for acquisition priority (U.S. Fish and Wildlife Service et al. 1990). This model is a geographic information system (GIS) which relies heavily on accurate mapping of wildlife densities, especially waterfowl. The techniques developed by MBM produce improved waterfowl density distribution coverages that can be easily incorporated into the APS model.

Our specific objectives were to:

1. Provide improved population estimates of waterfowl within the duck production stratum.

2. Provide waterfowl distribution maps of improved accuracy within the duck production stratum.

3. Provide waterfowl distribution coverages compatible with the Division of Realty's Alaska Priority System model and refuge computer systems.

4. Determine the relative abundance of waterfowl on federal versus non-federal lands within the duck production stratum.

5. Provide more intensive information on brood distribution and abundance.

Study Area

The refuge is located in eastcentral Alaska about 48 km (30 miles) west of the Canadian border. The refuge extends about 354 km (220 miles) east to west along the Arctic Circle and occupies about 45,246 km^2 (17,469 mi^2). The predominant feature is the Yukon River and associated floodplain which occupies the bulk of the refuge (Fig. 1). Approximately 24 percent (10,927 km^2) of the land inside the refuge boundary is privately owned, much of it by five native villages (Fig. 2). The Yukon Flats Duck Production Survey Stratum (DPS), covering 18,771 km^2, encompasses the majority of the waterfowl habitat on the Yukon Flats and most of the non-federal land (Fig. 3). Therefore, the DPS was the primary area of interest for this study.

Climate is continental subarctic with great seasonal extremes of temperature and daylight. The Yukon Flats has the highest summer temperatures of any place of comparable latitude in North America. The growing season is short but daylight is continuous for 84 days between around 13 May to 4 August. Precipitation is low at an average of 16.5 cm (6.5 inches) annually but because of

low evaporation, snow accumulation and permafrost, it is adequate for plant growth.

The average date of breakup of the Yukon River at Fort Yukon is 15 May and is often accompanied by extensive flooding. This flooding is the primary source of water for many of the waterbodies on the Flats. Breakup of the edges of smaller waterbodies may occur a week before breakup on the river and larger waterbodies a week or more after.

The Yukon Flats contains an abundance of ponds, sloughs, lakes, streams and rivers. This together with an estimated 50% of the refuge area consisting of riparian and wetland habitats with species such as water sedge (Carex aquatilis), water horsetail (Equisetum fluviatile), pond lily (Nuphar spp.) and pondweed (Potamogeton spp.) make the Yukon Flats one of the most productive waterfowl breeding areas in North America.

For more detailed information on the Yukon Flats area, see Lensink (1965), Lensink and Rothe (1986), Heglund (1988) and U.S. Fish and Wildlife Service (1964; 1987).

Methods

Breeding Pair Surveys

The North American breeding pair survey transects on the Yukon Flats stratum total 533 km (Fig. 4). Expanded breeding pair transects totaling 1,500 km were systematically located within the DPS and the refuge boundary along lines of longitude (Fig. 5) and flown in 1989 and 1990. In 1991, approximately 4,300 km of flightline transects were systematically placed within the DPS and the refuge boundary along meridians every 7.5 minutes (approximately 5.8 km or 3.5 miles) from 149°37.5' W to 141°15.0' W (Fig. 6). We flew the transects from 29 May to 1 June 1991 using 3 aircraft and 3 survey crews.

Survey methods followed the conventions established for breeding ground surveys in North America. Aircraft were flown at 137 to 153 kph (85 to 95 mph) at altitudes of 30 to 46 m (100 to 150 feet). Surveys were only flown in good weather with wind speed 24 kph (15 mph) or less, ceiling greater than 152 m (500 feet), and visibility greater than 16 km (10 miles). A Loran C was used for navigation to allow transects to be flown accurately.

The pilot/observer and right seat observer voiced transect numbers, segment numbers, direction of flight and all observations into continuously running cassette tape recorders. All birds were identified to species and categorized as a single, pair, or flock.